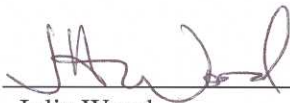


## CRITERION 724

## PREACTION SPRINKLER SYSTEMS

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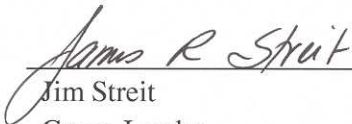
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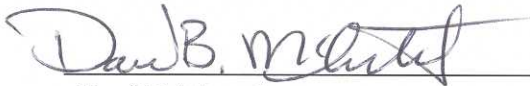
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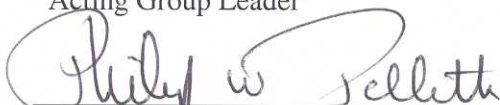
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**RECORD OF REVISIONS**

<b>Revision No.</b>	<b>Date</b>	<b>Description</b>
0	08/27/98	Initial Issue
1	06/19/02	This revision reflects the conversion from a WordPerfect document into a Microsoft Word document and additional clarification on how to develop criteria. This revision includes: <ul style="list-style-type: none"><li>• The addition of a Table of Contents,</li><li>• The use of basis statements in Sections 6, 7, and 9.</li><li>• Revision to Section 9, "Required Documents," and</li><li>• Further clarification in the use of references.</li></ul>
	9/12/02	<ul style="list-style-type: none"><li>• Changes per Writer's Guide changes and subcommittee requests for clarification.</li></ul>

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## **CRITERION 724**

### **PREACTION SPRINKLER SYSTEMS**

#### **1.0 PURPOSE**

The purpose of this Criterion is to establish the minimum requirements and best practices for operation and maintenance of preaction sprinkler systems at LANL.

This document addresses the requirements of LIR 230-05-01(Ref 10.1), "Operations and Maintenance Manual" and the requirements of LIR 402-910-01.4, "LANL Fire Protection Program."

Implementation of this Criterion satisfies DOE Order 430.1A (Ref 10.2) for the subject equipment / system. DOE Order 430.1A (Ref 10.2) "Life Cycle Asset Management," Attachment 2 "Contractor Requirements Document," Paragraph 2, Sections A through C, which in part requires UC to "...maintain physical assets in a condition suitable for their intended purpose," and employ "preventive, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition." Compliance with DOE Order 430.1A is required by Appendix G of the UC Contract.

#### **2.0 SCOPE**

The scope of this Criterion includes the routine inspection, testing and preventive and predictive maintenance of preaction sprinkler systems. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

#### **3.0 ACRONYMS AND DEFINITIONS**

##### **3.1 Acronyms**

<b>AHJ</b>	Authority Having Jurisdiction
<b>CAS</b>	Central Alarm Station
<b>CFR</b>	Code of Federal Regulations
<b>DOE</b>	Department of Energy
<b>FDC</b>	Fire Department Connection
<b>ITM</b>	Inspection, Testing, and Maintenance
<b>LIR</b>	Laboratory Implementation Requirement
<b>LPR</b>	Laboratory Performance Requirement
<b>NFPA</b>	National Fire Protection Association

<b>OIC</b>	Office of Institutional Coordination
<b>O&amp;M</b>	Operations and Maintenance
<b>PPE</b>	Personal Protective Equipment
<b>PP&amp;PE</b>	Personal Property and Programmatic Equipment
<b>RP&amp;IE</b>	Real Property and Installed Equipment
<b>SSC</b>	Structures, Systems, and Components
<b>SSS</b>	Support Services Subcontractor
<b>UC</b>	University of California

## 3.2 Definitions

**Management Level Determination (ML1, ML2, ML3, ML4)**-A classification system for determining the degree of management control applied to facility work. See LIR 230-01-02 for definitions of each ML level.

**Preaction Sprinkler System** – A sprinkler system that is filled with water only from the underground fire main up to the system control valve and system preaction valve. The piping downstream to the sprinklers is normally dry. A preaction sprinkler system requires actuation of area fire detection to allow water to be released into the piping downstream of the system control valve and preaction valve. Release of water from the system will not occur unless the fusible element on a system sprinkler melts, causing the sprinkler to open.

## 4.0 RESPONSIBILITIES

### 4.1 FWO-Systems, Engineering and Maintenance (FWO-SEM)

**4.1.1** FWO-SEM is responsible for the administrative content of this Criterion and monitoring the applicability and the implementation status of this Criterion and either assisting the organizations that are not applying or meeting the implementation expectations contained herein or elevating their concerns to the director(s).

*Basis:* LIR 301-00-01.11; Issuing and Managing Laboratory Operations Implementation Requirements and Guidance, Section 5.4, OIC Implementation Requirements.

**4.1.2** FWO-SEM shall provide technical assistance to support implementation of this Criterion.

**4.2 FWO-Fire Protection (FWO-FIRE)**

- 4.2.1** FWO-FIRE is responsible for the technical content of this Criterion and monitoring the proper implementation across the Laboratory.
- 4.2.2** FWO-FIRE shall provide technical assistance to support implementation of this Criterion.

**4.3 Facility Manager**

- 4.3.1** Responsible for operations and maintenance of institutional, or Real Property and Installed Equipment (RP&IE) under their jurisdiction, in accordance with the requirements of this document.
- 4.3.2** Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document that may be assigned to the FM in accordance with the FMU-specific Facility/Tenant Agreement.

**4.4 Group Leader**

- 4.4.1** Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document, which are under their jurisdiction.
- 4.4.2** Responsible for system performance and subsequent replacement or refurbishment of assigned PP&PE.

**4.5 Authority Having Jurisdiction (AHJ) – LANL Fire Marshal**

- 4.5.1** The AHJ is responsible for providing a decision on a specific technical question regarding this Criterion.
- 4.5.2** The LANL Fire Marshal is the approval authority for any exceptions and variances to this Criterion.

**4.6 Support Services Subcontractor (SSS)**

- 4.6.1** Responsible for providing ITM of the fire protection systems addressed in this Criterion at the request of the responsible Facility Manager.
- 4.6.2** Responsible for coordinating work with operating group and Facility Manager to conduct ITM in the affected area.

## **5.0 PRECAUTIONS AND LIMITATIONS**

### **5.1 Precautions**

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. A compilation of all applicable precautions shall be contained in the implementing procedure(s) or work control authorization documents. The following precautions are intended only to assist the author of a procedure or work control document in the identification of hazards/precautions that may not be immediately obvious.

### **5.2 Limitations**

The intent of this Criterion is to identify the minimum generic requirements and recommendations for SSC operation and maintenance across the Laboratory. Each user is responsible for the identification and implementation of additional facility specific requirements and recommendations based on their authorization basis and unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, vendor O&M requirements and guidance, etc.).

Nuclear facilities and moderate to high hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion. Nuclear facilities shall implement the requirements of DOE Order 4330.4B (Ref. 10.3) as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be necessary to fully comply with the current DOE Order or CFR identified above.

## **6.0 REQUIREMENTS**

Minimum requirements that Criterion users shall follow are specified in this section. Requested variances and exceptions to these requirements shall be prepared and submitted to FWO-SEM in accordance with LIR 301-00-02 (Ref. 10.4), "Variances and Exceptions to Laboratory Operations Requirements," for review and approval. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgement, safety matters, and operations and maintenance experience drive the requirements contained in this section. Variances and exceptions to this Criterion shall be approved by the LANL Fire Marshal.

## **6.1 Operations Requirements**

### **6.1.1 Operational Checklist**

The preaction sprinkler system must remain operational at all times. The preaction sprinkler system shall be deemed operational when the following conditions are met:

- the system control valve is open,
- an adequate water supply is available (with appropriate water pressure and quantity – compare to previous satisfactory test results),
- the associated detection system is in-service and connected to the preaction valve activation device,
- piping, fittings, hangers, sprinklers, valve trim, and other components are in their proper configuration and in good condition,
- the piping downstream of the preaction valve is filled with nitrogen or air at an appropriate pressure (compare to previous satisfactory test results),
- the water flow alarm is operational,
- sprinklers are unobstructed (ref. NFPA 13, Section 5-6),
- where intermediate sprinklers might be cooled by sprinklers located above, the intermediate level sprinklers are equipped with spray shields,
- sprinklers are a sufficient horizontal distance from ceiling height obstructions so that sprinkler spray pattern is not significantly obstructed (use engineering judgment and refer to NFPA 13 for restrictions),
- pendent and upright sprinklers are at least 4” from wall,
- continuous or non-continuous obstructions such as storage and partial-height partitions are at least 18” below sprinkler deflectors, and
- where fixed continuous or non-continuous obstructions beneath sprinklers are more than 48” wide (ex.,: scaffold, platforms, ductwork, cable trays, cutting tables), sprinklers must be provided underneath.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Chapter 5; NFPA 13, 1999 Edition Standard for the Installation of Sprinkler Systems, Section 5-6; and NFPA 72, National Fire Alarm Code, 1999. Compliance with NFPA code is required per Appendix G of the UC contract.

**6.1.2 Daily Inspection(s)**

- 6.1.2.1** Valve enclosure heating equipment, for valves subject to freezing, shall be inspected DAILY during cold weather for its ability to maintain a minimum temperature of at least 4 degrees C (40 degrees F).

EXCEPTION: Where riser enclosures are equipped with low temperature alarms, visually inspect riser enclosure heating equipment WEEKLY.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Chapter 12. Compliance with this NFPA code is required per Appendix G of the UC contract.

**6.1.3 Semi-Annual Inspection(s) [twice a year]**

- (a) Visually inspect the systems hydraulic nameplate, if provided, to verify that it is securely attached and legible. (NOTE: The nameplate may contain hydraulic calculation information applicable to the sprinkler system. If the sprinkler riser does not have a nameplate, this requirement is not applicable.)
- (b) Visually inspect system valves, alarm devices, water flow devices, and gauges. Visually inspect preaction valve per Section 6.2.1.2.1. Other valves, alarm devices, water-flow devices, and gauges shall be visually inspected to verify that they are free of physical damage. Valves shall also be verified to be in their proper position.
- (c) Visually inspect Fire Department Connections semi-annually to verify the following:
  - FDCs are visible and accessible
  - couplings or swivels are undamaged and rotate smoothly,
  - plugs and caps are in place and undamaged,
  - interior of the connection is unobstructed and valve clapper is operational over its full range when the FDC is plugged or if caps are out of place,
  - gaskets are in place and in good condition,
  - identification signs are in place,
  - check valve is not leaking,
  - the automatic drain valve is in place and operating properly, and
  - components are cleaned, repaired, or replaced as necessary in accordance with the manufacturer's instructions.
  - FDC clapper(s) is in place and operating smoothly.

*Basis:* Equivalency to NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Table 5.1.

#### **6.1.3.1 Preaction Valves**

Inspect preaction valve to verify the following:

- The valve is free of physical damage.
- Trim valves are in their proper position.
- There is no leakage from the valve seat.
- Electrical components are in service.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Chapter 12 and Semi-Annual recommendation per DOE approved equivalency to NFPA 25. Compliance with this NFPA code is required per Appendix G of the UC contract.

#### **6.1.3.2 Other Components**

- Extinguishing system initiating devices (detection, etc.) shall be visually inspected per O&M Criterion 720, Fire Alarm Systems.

#### **6.1.4 Annual Inspection**

(a) Visually inspect the entire system (piping and fittings, seismic bracing hangers, sprinkler heads including spares, sprinkler obstructions, and unprotected spaces) to verify Operational and to ensure the system is free of mechanical damage.

- Pipe, fittings, hangers and seismic braces installed in concealed spaces such as above suspended ceilings shall not require inspection.
- Pipe and hangers installed in areas that are inaccessible for safety considerations due to process operations shall be inspected during each scheduled shutdown.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Chapter 5 and Table 5.1.

(b) Visually inspect all system valves to ensure the following:

- are in the correct position (normally open),
- are locked or supervised,
- are accessible,
- are free from external leaks, and
- have appropriate identification.

(c) Inspect gauges to ensure that:

- gauges have up-to-date calibration,
- normal supply-side pressure is maintained, and
- appropriate system-side air or nitrogen pressure is maintained.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Chapter 5 and Chapter 12.

(d) The supply of spare sprinklers shall be inspected for:

- the proper number and type of sprinklers (see Section 6.4.1, 3<sup>rd</sup> bullet), and
- a sprinkler wrench for each type of sprinkler.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection of Water-based Fire Protection Systems, Chapter 5 and Chapter 2-2. Compliance with this NFPA code is required per Appendix G of the UC contract.

### **6.1.5 5-Year Inspection**

- Internally inspect all check valves to verify components operate properly, move freely, and are in good condition. Clean, repair, or replace the internal components as necessary in accordance with the manufacturer's instructions.
- Internally inspect strainers, filters, and restricted openings every 5 years, unless tests indicate that a more stringent frequency is required.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection of Water-based Fire Protection Systems, Chapter 5. Compliance with this NFPA code is required per Appendix G of the UC contract.

## **6.2 Maintenance Requirements**

Maintain the system in operating condition. Repair or replace any components failing a test or inspection in accordance with the manufacturer's instructions.

### **6.2.1 Sprinklers**

- (a) Replacement sprinklers shall have the appropriate characteristics for the application intended, these characteristics include proper:
  - style,
  - orifice size and K factor,
  - temperature rating,
  - coating (if any),
  - deflector type (e.g., upright, pendant, sidewall), and
  - design requirements.
- (b) Use only new, listed sprinklers to replace existing sprinklers.
- (c) Facility and/or LANL SSS shall store a supply of at least 6 spare sprinklers proportionally representative of the types and temperature ratings of the system sprinklers.
- (d) Conduct an obstruction investigation for sprinkler systems and yard main piping whenever any of the following conditions exist:
  - plugged piping in sprinkler systems dismantled during building alterations are discovered,
  - failure to flush yard piping or surrounding public mains following new installations or repairs,
  - record of broken public mains in the vicinity exists,
  - abnormally frequent false tripping of a dry pipe valve(s),
  - there is reason to believe that the sprinkler system contains sodium silicate or highly corrosive fluxes in copper systems,
  - a system has been supplied with raw water via the fire department connection,
  - pinhole leaks are found,
  - there is a 50-percent increase in the time it takes water to travel to the inspector's test connection from the time the valve trips during a full flow trip test of a dry pipe sprinkler system when compared to the original system acceptance test,
  - discharge of obstructive materials is found during routine water flow tests,
  - foreign materials are discovered in fire pumps or check valves,

- heavy discoloration of water during drain tests or plugging of inspectors test connection is found,
- plugging of sprinklers is discovered,
- following repair of water mains in the vicinity,
- a system is returned to service after an extended period (normally greater than 1 year).

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems, Chapter 13.2.

### **6.2.2 Control Valves**

- Annually lubricate the operating stems of each outside screw and yoke (OS&Y) valves. Close and reopen the valve completely to test its operation and distribution of the lubricant. Graphite lubricant is recommended.
- Clean, repair, or replace internal components as needed in accordance with the manufacturer's recommendations.

NOTE: Do not apply grease or other sealing materials to the seating surfaces of valves.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection of Water-based Fire Protection System, Chapter 12. Compliance with this NFPA code is required per Appendix G of the UC contract.

### **6.2.3 Preaction Valves**

- During the annual trip test, thoroughly clean the interior of the preaction valve, and replace or repair any parts as necessary.
- Drain the low points in preaction systems after each operation and before the onset of freezing weather conditions.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection System, Chapter 12 and Section 12.4.3.3. Compliance with this NFPA code is required per Appendix G of the UC contract

## **6.3 Testing**

### **6.3.1 Semi-Annual [twice a year]**

- Test the system alarms by using the alarm bypass connection.
- Test the priming water level in supervised preaction systems.

- Test low supervisory nitrogen or air pressure alarms in accordance with manufacturer's instructions.
- Test control valve supervisory switches.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems, Chapter 12. Compliance with this NFPA code is required per Appendix G of the UC contract.

### **6.3.2 Annual Testing**

- Fully close and reopen the system control valve(s).
- During warm weather, trip test each preaction valve in accordance with the manufacturer's instructions.
- Inspect the interior of the preaction valve when the trip test is conducted.

**EXCEPTION:** In protected properties where water cannot be discharged into the piping for test purposes, conduct the trip test so it will not require discharge into the piping area.

**NOTE:** After the trip test, return the system to service in accordance with the manufacturer's instructions.

- When water cannot be discharged into the piping for test purposes, a main drain test shall be conducted to verify availability of water to the preaction valves and to determine if there has been a change in the condition of the water supply piping and control valves.

**NOTE:** Maintain records that indicate when the preaction valve was last tripped, the actual tripping time, and the individual and organization conducting the test. These records shall be kept in a location that is readily available for viewing by the AHJ.

- Test low temperature alarms at the start of the heating season, if installed.
- Operate manual actuation devices.
- Test automatic supervisory air or nitrogen pressure maintenance devices during the annual preaction or deluge valve trip test in accordance with the manufacturer's instructions.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection of Water-based Fire Protection Systems, Chapter 12. Compliance with this NFPA code is required per Appendix G of the UC contract.

**6.3.3 2-Year Testing**

- For fire detection system(s) associated with a preaction sprinkler system, test each initiation device (manual and automatic) in accordance with the manufacturer's instructions, and test duration of battery backup power supply.

*Basis:* DOE approved equivalency to NFPA 72, National Fire Alarm Code. Compliance with this NFPA code is required per Appendix G of the UC contract.

**6.3.4 5-Year Testing**

- Replace gauges or test by comparison to a calibrated gauge.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection of Water-based Fire Protection Systems, Section 12.2.8.2. Compliance with this NFPA code is required per Appendix G of the UC contract.

**6.3.5 Other Time Frames**

See Appendix A, Sprinkler Testing Requirements for specific criteria.

**6.4 Impairments and Modifications**

If one or more of the Operational requirements listed in Section 6.1.1 are not maintained, follow the actions outlined in Criterion 733, Fire Protection System Impairment Control Program.

**6.4.1 Inspection (after any Impairment or Modification)**

Visually inspect the system before returning it to service. See Appendix B.

**6.4.2 Testing (after any Impairment or Modification, and prior to returning the system to service)**

- Check the water supply to verify an adequate pressure and volume of water is available at the system connection.
- Test the main drain to verify the control valve is open.
- Test using the alarm bypass connection to verify the system local audible alarm and/or alarm signal to the Central Alarm Station (CAS) will operate within the required time.
- Flush (if required by NFPA 13) and hydrostatically test any repaired parts of the system before returning it to service (where modification affects system pressure boundary or flow path).

- Test the activation system to verify fire detectors are in place and will operate the preaction valve. The sprinkler water control valve must be closed for this test.

*Basis:* NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems Section 14.7 and NFPA 72, National Fire Alarm Code, 1999 Edition. Compliance with this NFPA code is required per Appendix G of the UC contract.

## **6.5 Personnel**

- 6.5.1** Operational testing and alarm verification will be conducted by SSS personnel, in compliance with LIR 402-910-01, Section 6.0.

*Basis:* LIR 402-910-01.4, LANL Fire Protection Program

## **7.0 RECOMMENDATIONS AND GOOD PRACTICES**

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each user based on his/her unique application and operating history of the subject systems/equipment.

### **7.1 Operations Recommendations**

None available.

### **7.2 Maintenance Recommendations**

- 7.2.1** Persons other than SSS Fire Protection Maintenance personnel may conduct visual inspection requirements identified in this document.

*Basis:* LIR 402-910-01.4, LANL Fire Protection Program

## **8.0 GUIDANCE**

### **8.1 Operations Guidance**

Not applicable

### **8.2 Maintenance Guidance**

Not applicable

## **9.0 REQUIRED DOCUMENTATION**

Maintenance history shall be maintained by the FM for preaction sprinkler systems to include, as a minimum, the parameters listed in the Table 9-1 below:

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
PARAMETER	ML 1	ML 2	ML 3	ML 4
<b>Preaction Sprinkler System Maintenance Activities</b>				
Repair / Adjustments	X	X	X	X
PM Activities	X	X	X	X
<b>Preaction Sprinkler System Equipment Problems</b>				
Failure Dates	X	X	X	X
Failure Root Cause	X	X	X	X
<b>Preaction Sprinkler System Inspection Results (per this Criterion)</b>				
Inspection Date	X	X	X	X
SSC Condition	X	X	X	X

*Basis:* Documentation of the parameters listed in Table 9-1 above satisfies the requirements of LPR 230-07-00, Criteria 2, (Ref. 10.5) which states; “Maintenance activities, equipment problems, and inspection and test results are documented.”

## 10.0 REFERENCES

The following references, and associated revisions, were used in the development of this document.

- 10.1 LIR 230-05-01.0, Operations and Maintenance Manual.
- 10.2 DOE O 430.1A, Attachment 2 “Contractor Requirements Document” (Paragraph 2, Sections A through C), a requirement of Appendix G of the UC Contract.
- 10.3 DOE Order 4330.4B, Maintenance Management Program, Section 3.4.9.
- 10.4 LIR 301-00-02.0, Variances and Exceptions to Laboratory Operation Requirements.
- 10.5 LPR 230-07-00, Maintenance History, Performance Criteria [2].
- 10.6 LIR 402-910-01.4, LANL Fire Protection Program
- 10.7 NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems.

**10.8** NFPA 72, National Fire Alarm Code, 1999 Edition

**10.9** DOE approved equivalencies for NFPA 25 and NFPA 72.

**10.10** Criterion 733, Fire Protection System Impairment Control Program, LANL Operations and Maintenance Manual

## **11.0 APPENDICES**

**Appendix A:** Sprinkler Testing Requirements

**Appendix B:** Visual Inspection After Repair Checklist

### **Appendix A Sprinkler Testing Requirements**

(Basis: NFPA 25, 2002 Edition Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, Section 5.3)

1. Where required below, sample sprinklers shall be submitted to a recognized testing laboratory acceptable to the AHJ for field service testing.
  - Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested. Test procedures shall be repeated at 10-year intervals.
  - Sprinklers manufactured using fast-response elements that have been in service for 20 years shall be tested. They shall be tested at 10-year intervals.
  - Representative samples of solder-type sprinklers with a temperature classification of extra high 163°C (325°F) or greater that are exposed to semi-continuous to continuous maximum allowable ambient temperature conditions shall be tested at 5-year intervals.
  - Where sprinklers have been in service for 75 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory acceptable to the AHJ for field service testing. Test procedures shall be repeated at 5-year intervals.
  - Dry sprinklers that have been in service for 10 years shall be tested or replaced. If maintained and serviced, they shall be retested at 10-year intervals.
  - Where sprinklers are subjected to harsh environments, including corrosive atmospheres and corrosive water supplies, on a 5-year basis, sprinklers shall either be replaced or representative sprinkler samples shall be tested.
  - Where historical data indicates, longer intervals between testing shall be permitted.
2. A representative sample of sprinklers for testing per step 1 above shall consist of a minimum of not less than 4 sprinklers or 1% of the number of sprinklers per individual sprinkler sample, whichever is greater.
3. Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers represented by that sample shall be replaced.

**Appendix B****Visual Inspection After Repair Checklist**

1. Inspect piping and joints for proper alignment.
2. Ensure material and method of repair is acceptable.
3. Check the system for leaks.
4. Ensure pipe hangers are adequate.
5. If sprinkler heads were replaced, ensure the type and temperature ratings meet the original specifications.